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Regulatory Overview

This chapter presents an overview of the following items.

- National and California Department of Health Services (DHS) regulations for treated drinking water and monitoring during the survey period 1996-2000.
- Recent and proposed rules as of February 2001.
- Drinking water quality concerns related to Delta water supplies and contaminants of recent public concern.

Following are abridged excerpts and edited material from federal and State agency publications. Further detailed information about current and proposed drinking water-related rules can be obtained from the Web sites of the US Environmental Protection Agency Office of Water (www.epa.gov/safewater) and DHS (www.dhs.ca.gov/ps/ddwem).

2.1 DRINKING WATER REGULATIONS

2.1.1 PRIMARY AND SECONDARY MCLS AND ACTION LEVELS

There are many contaminants that may be present in source water before it is treated. At certain concentrations, some contaminants can cause harm to human health while others—for example, bromide—can make it difficult for treatment plants to meet treated drinking water standards for disinfection byproducts such as trihalomethanes. These contaminants can be grouped into 5 classes:

1) Inorganic contaminants such as mineral salts and metals from either natural sources or from wastewater discharges, urban storm water runoff, mining, agriculture, and home uses.
2) Organic chemical contaminants such as synthetic and volatile organic chemicals, from manufacturing, petroleum refineries, gasoline and septic tanks, and urban runoff.
3) Agricultural and landscape chemicals (organic and inorganic) such as pesticides and herbicides from farms, homes, and urban drainages.
4) Microbial contaminants such as bacteria and viruses, from septic tanks, sewage treatment plants, livestock, and wildlife.
5) Radioactive materials from natural and industrial sources, for example, mining.

Congress passed the Safe Drinking Water Act (SDWA) of 1974 to set drinking water standards for the protection of human health. The act was amended in 1986 and 1996 to meet additional concerns about unregulated drinking water contaminants.

The major points of the SDWA follow:

- Authorizes the US Environmental Protection Agency (EPA) to set enforceable health standards—for example, maximum contaminant levels (MCLs)—for drinking water contaminants;
- Requires public notification of water systems' violations and annual reports to consumers on the levels of contaminants in their drinking water;
- Establishes a federal-state partnership for enforcement of regulations;
- Includes provisions to protect underground drinking water sources;
- Requires disinfection of surface water and, as necessary, groundwater used for drinking;
- Requires filtration of all surface water supplies except those with pristine, protected sources;
- Establishes a state revolving loan fund for water system improvements; and
- Requires an assessment of all drinking water sources' vulnerability to contamination.

California is a "primacy" state that implements the federal SDWA on behalf of the EPA. California develops and implements its own drinking water standards that must be at least as stringent as federal standards.

The national and California primary drinking water standards, or MCLs, are presented in Tables 2-1 and 2-2, which list MCLs, potential health effects from exposure above the MCL, and common sources

of each contaminant in drinking water. Primary MCLs are enforceable regulatory levels under the SDWA and must be met by all public drinking water systems to which they apply. DHS added contaminants to the list and lowered some MCLs.

California has 78 chemical and 6 radioactive contaminants that have primary MCLs. The list of primary MCLs are covered in Title 22 California Code of Regulations (CCR) for inorganic chemicals (§ 64431), trihalomethanes (§ 64439), radioactivity (§ 64441 and § 64443), and organic chemicals (§ 64444). Specific regulations for lead and copper levels at customer taps and in the water distribution system are stated in Title 22 CCR § 64670.

Table 2-1 National and California Primary Drinking Water Standards for Inorganic Chemicals

National Primary MCLs and California Dept. of Health Services (DHS) MCLs are same unless noted. For some contaminants DHS has either established lower MCLs for California or set MCLs not set by EPA.

Contaminant	MCL[a] or TT [b] (mg/L)	Possible Health Effects from Exposure Above the MCL	Common Sources of Contaminants in Drinking Water
Aluminum	1	May be linked to Alzheimer's disease and other dementia; neurotoxic	Discharges from waste sites, manufacturing plants naturally high areas, or
Antimony	0.006	Increase in blood chlolesterol; decrease in blood sugar	Discharge from petroleum refineries; fire retardants; ceramics; electronics; solder
Arsenic	0.05 0.01 *effective* 22 Feb 2002*	Skin damage; circulatory system problems; increased risk of cancer	Erosion of natural deposits; runoff from orchards; runoff from glass and electronics production wastes
Asbestos (fibers >10 micrometers)	7 million fiberg per liter (MFL)	Increased risk of developing benign intestinal polyps	Decay of asbestos cement in water mains; erosion of natural deposits
Barium	2 1 (DHS)	Increase in blood pressure	Discharge of drilling wastes; discharge from metal refineries; erosion of natural deposits
Beryllium	0.004	Intestinal lesions	Discharge from metal refineries and coal-burning factories; discharge from electrical, aerospace, and defense industries
Cadmium	0.005	Kidney damage	Corrosion of galvanized pipes; erosion of natural deposits; discharge from metal refineries; runoff from waste batteries and paints
Chromium (total)	0.1 0.05 (DHS)	Allergic dermatitis	Discharge from steel and pulp mills; erosion of natural deposits
Copper	Action Level=l.3; TT[c]	Short term exposure: Gastrointestinal disorders. Long term exposure: Liver or kidney damage. Those with Wilson's Disease should consult their personal doctor if the amount of copper in their water exceeds the action level	Corrosion of household plumbing systems; erosion of natural deposits; leaching from wood preservatives
Cyanide (as free cyanide)	0.2	Nerve damage or thyroid problems	Discharge from steel/metal factories; discharge from plastic and fertilizer factories

Table 2-1 (continued)

Contaminant	MCL[a] or TT[b] (mg/L)	Possible Health Effects from Exposure Above the MCL	Common Sources of Contaminants in Drinking Water
Fluoride	4.0 2.0 (DHS)	Bone disease (pain and tenderness of the bones) Children may get mottled teeth	Water additive which promotes strong teeth; erosion of natural deposits; discharge from fertilizer and aluminum factories
Lead	Action Level=0.015; TT[c]	Infants and children: Delays in physical or mental development; children could show slight deficits in attention span and learning abilities Adults: Kidney problems; high blood pressure	Corrosion of household plumbing systems; erosion of natural deposits
Mercury (inorganic)	0.002	Kidney damage	Erosion of natural deposits; discharge from refineries and factories; runoff from landfills and croplands
Nickel	0.1 (DHS)	Animal laboratory studies showed genotoxic and carcinogenic effects	Discharges from electroplating plants and metals and machinery manufacturing plants
Nitrate (measured as Nitrogen) Nitrate (measured as Nitrate) Nitrate + Nitrite (measured as sum of Nitrogen)	10 45 (DHS) 10 (DHS)	Infants below the age of 6 months who drink water containing nitrate in excess of the MCL could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue-baby syndrome.	Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural deposits
Nitrite (measured as Nitrogen)	1	Infants below the age of 6 months who drink water containing nitrite in excess of the MCL could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue-baby syndrome.	Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural deposits
Selenium	0.05	Hair or fingernail loss; numbness in fingers or toes; circulatory problems	Discharge from petroleum refineries; erosion of natural deposits; discharge from mines
Thallium	0.002	Hair loss; changes in blood; kidney, intestine, or liver problems	Leaching from ore-processing sites discharge from electronics, glass, and drug factories

Sources: EPA, Office of Water (4606), National Primary Drinking Water Standards, EPA 810-F-94-001, Dec 1999. DHS, MCLs, Action Levels, and Unregulated Chemicals Requiring Monitoring, Updated 13 Nov 2000 http://www.dhs.ca.gov/ps/ddwem/chemicals/MCL/mclindex.htm

[a] Maximum Contaminant Level (MCL) - The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to MCLGs as feasible using the best available treatment technology and taking cost into consideration. MCLs are enforceable standards.

[b] Treatment Technique (TT) - A required process intended to reduce the level of a contaminant in drinking water,

[c] Lead and copper are regulated using a Treatment Technique that requires systems to control the corrosiveness of their water. The action level serves as a trigger for water systems to take additional treatment steps if exceeded in more than 10% of tap water samples. For copper, the action level is 1.3 mg/L; for lead, 0.015 mg/L.

Table 2-2 National and California Primary Drinking Water Standards for Organic Chemicals, Radionuclides, and Microorganisms

Contaminant	MCL[a] or TT[b] (mg/L)	Potential Health Effects from Exposure Above the MCL	Common Sources of Contaminants in Drinking Water
		Organic Chemicals	
Acrylamide	TT	Nervous system or blood problems; increased risk of cancer	Added to water during sewage/wastewater treatment
Alachlor (Alanex)	0.002	Eye, liver, kidney or spleen problems; anemia; increased risk of cancer	Runoff from herbicide used on row crops
Atrazine (Aatrex)	0.003	Cardiovascular system or reproductive problems	Runoff from herbicide used on row crops
Bentazon (Basagran)	0.018 (DHS)		
Benzene	0.005 0.001 (DHS)	Anemia; decrease in blood platelets; increased risk of cancer	Discharge from factories; leaching from gas storage tanks and landfills
Benzo(a)pyrene	0.0002	Reproductive difficulties; increased risk of cancer	Leaching from linings of water storage tanks and distribution lines
Carbofuran (Furadan)	0.04 0.018 (DHS)	Problems with blood, nervous system, or reproductive system	Leaching of soil fumigant used on rice and alfalfa
Carbon tetrachloride	0.005 0.0005 (DHS)	Liver problems; increased risk of cancer	Discharge from chemical plants and other industrial activities
Chlordane	0.002 0.0001 (DHS)	Liver or nervous system problems; increased risk of cancer	Residue of banned termiticide
Chlorobenzene (Monochlorobenzene)	0.1 0.07 (DHS)	Liver or kidney problems	Discharge from chemical and agricultural chemical factories
(2,4-Dichlorophenoxy)acetic Acid (2,4-D)	0.07	Kidney, liver, or adrenal gland problems	Herbicide use
Dalapon	0.2	Minor kidney changes	Runoff from herbicide used on rights of way
l,2-Dibromo-3-chloropropane (DBCP)	0.0002	Reproductive difficulties; increased risk of cancer	Runoff/leaching from soil fumigant used on soybeans, cotton, pineapples, and orchards
o-Dichlorobenzene (o-DCB)	0.6	Liver, kidney, or circulatory system problems	Discharge from industrial chemical factories
p-Dichlorobenzene (p-DCB)	0.075 0.005 (DHS)	Anemia; liver, kidney or spleen damage; changes in blood	Discharge from industrial chemical factories
1,1-Dichloroethane (1,1-DCA)	0.005	Possible human carcinogen	Discharge from industrial chemical factories
l,2-Dichloroethane (1,2-DCA)	0.005 0.0005 (DHS)	Increased risk of cancer	Discharge from industrial chemical factories
1-1-Dichloroethylene	0.007	Liver problems	Discharge from industrial chemical factories

Table 2-2 (continued)

Contaminant	MCL[a] or TT[b] (mg/L)	Potential Health Effects from Exposure Above the MCL	Common Sources of Contaminants in Drinking Water
cis-l, 2-Dichloroethylene	0.07 0.006 (DHS)	Liver problems	Discharge from industrial chemical factories
trans-l,2-Dichloroethylene	0.1(DHS)	Liver problems	Discharge from industrial chemical factories
Dichloromethane (Methylene chloride)	0.005	Liver problems; increased risk of cancer	Discharge from drug and chemical factories
l-2-Dichloropropane (Propylene dichloride)	0.005	Increased risk of cancer	Discharge from industrial chemical factories
Di(2-ethylhexyl)adipate	0.4	General toxic effects or reproductive difficulties	Discharge from chemical factories
Di(2-ethylhexyl) phthalate (DEHP)	0.006 0.004 (DHS)	Reproductive difficulties; liver problems; increased risk of cancer	Discharge from rubber and chemical factories
Dinoseb	0.007	Reproductive difficulties	Runoff from herbicide used on soybeans and vegetables
Dioxin (2,3,7,8-TCDD)	0.00000003	Reproductive difficulties; increased risk of cancer	Emissions from waste incineration and other combustion; discharge from chemical factories
Diquat	0.02	Cataracts	Runoff from herbicide use
Endothall	0.1	Stomach and intestinal problems	Runoff from herbicide use
Endrin	0.002	Liver problems	Residue of banned insecticide
Epichlorohydrin	TT	Increased cancer risk, and over a long period of time, stomach problems	Discharge from industrial chemical factories; an impurity of some water treatment chemicals
Ethylbenzene (Phenylethane)	0.7	Liver or kidneys problems	Discharge from petroleum refineries
Ethylene dibromide (EDB)	0.00005	Problems with liver, stomach, reproductive system, or kidneys; increased risk of cancer	Discharge from petroleum refineries
Glyphosate	0.7	Kidney problems; reproductive difficulties	Runoff from herbicide use
Heptachlor	0.0004 0.00001 (DHS)	Liver damage; increased risk of cancer	Residue of banned termiticide
Heptachlor epoxide	0.0002 0.00001 (DHS)	Liver damage; increased risk of cancer	Breakdown of heptachlor
Hexachlorobenzene	0.001	Liver or kidney problems; reproductive difficulties; increased risk of cancer	Discharge from metal refineries and agricultural chemical factories
Hexachloro-cyclopentadiene	0.05	Kidney or stomach problems	Discharge from chemical factories

Table 2-2 (continued)

Contaminant	MCL[a] or TT[b] (mg/L)	Potential Health Effects from Exposure Above the MCL	Common Sources of Contaminants in Drinking Water
Lindane (gamma-BHC)	0.0002	Liver or kidney problems	Runoff/leaching from insecticide used on cattle, lumber, gardens
Methoxychlor	0.04	Reproductive difficulties	Runoff leaching from insecticide used on fruits, vegetables, alfalfa, livestock
Molinate (Ordram)	0.02 (DHS)	Under study	Rice herbicide applications and draining rice fields
Methyl tert-Butyl Ether (MTBE)	0.013 (DHS)	Under study	Leaking underground storage tanks and pipelines, spills, emissions from gasoline marine engines, and air deposition
Oxamyl (Vydate)	0.2	Slight nervous system effects	Runoff/leaching from insecticide used on apples, potatoes, and tomatoes
Polychlorinated biphenyls (PCBs)	0.0005	Skin changes; thymus gland problems; immune deficiencies; reproductive or nervous system difficulties; increased risk of cancer	Runoff from landfills; discharge of waste chemicals
Pentachlorophenol	0.001	Liver or kidney problems; increased cancer risk	Discharge from wood preserving factories
Picloram	0.5	Liver problems	Herbicide runoff
Simazine (Princep)	0.004	Problems with blood	Herbicide runoff
Styrene	0.1	Liver, kidney, or circulatory system problems	Discharge from rubber and plastic factories; leaching from landfills
1,1,2,2-Tetrachloroethane	0.001 (DHS)		
Tetrachloroethylene (PCE)	0.005	Liver problems; increased risk of cancer	Discharge from factories and dry cleaners
Thiobencarb (Bolero)	0.07 (DHS)		Discharge from rice fields
Toluene (Methylbenzene)	10.15 DHS	Nervous system, kidney, or liver problems	Discharge from petroleum factories
Total Trihalomethanes (TTHMs)	0.10	Liver, kidney or central nervous system problems; increased risk of cancer	Byproduct of drinking water disinfections
Toxaphene	0.003	Kidney, liver, or thyroid problems; increased risk of cancer	Runoff/leaching from insecticide used on cotton and cattle
2,4,5-TP(Silvex)	0.05	Liver problems	Residue of banned herbicide
1,2,4-Trichlorobenzene (Unsym-Trichlorobenzene)	0.07 (DHS)	Changes in liver, kidneys, and adrenal glands.	Discharge from textile finishing factories.
1,2,4-Trichlorobenzene	0.07	Changes in adrenal glands	Discharge from textile finishing factories

Table 2-2 (continued)

Contaminant	MCL[a] or TT[b] (mg/L)	Potential Health Effects from Exposure Above the MCL	Common Sources of Contaminants in Drinking Water
1,1,1- Trichloroethane (1,1,1-TCA)	0.2	Liver, nervous system, or circulatory problems	Discharge from metal degreasing sites and other factories
1,1,2- Trichloroethane (1,1,2-TCA)	0.005	Liver, kidney, or immune system problems	Discharge from industrial chemical factories
Trichloroethylene (TCE)	0.005	Liver problems; increased risk of cancer	Discharge from metal degreasing sites and other factories
Trichlorofluoro-methane (Freon 11)	0.15 (DHS)	Effects on central nervous system	Discharge from metal cleaning sitres.
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	1.2 (DHS)	Effects on central nervous system	Discharge from metal cleaning sitres
Vinyl chloride	0.002 0.0005 (DHS)	Increased risk of cancer	Leaching from PVC pipes; discharge from plastic factories
Xylenes (total) Single isomer or sum of isomers	10 1.75 (DHS)	Nervous system damage	Discharge from petroleum factories; discharge from chemical factories
		Radionuclides	
Beta particles and photon emitters	4 millirems per year (mrem/yr)	Increased risk of cancer	Decay of natural and man-made deposits of certain minerals that are radioactive and may emit forms of radiation known as photons and beta radiation
Gross beta particle activity	50 picocuries per liter (pCi/L)(DHS)		
Gross alpha particle activity	15 (pCi/L)	Increased risk of cancer	Erosion of natural deposits of certain minerals that are radioactive and may emit a form of radiation known as alpha radiation
Radium 226 and Radium 228 (combined)	5 pCi/L	Increased risk of cancer	Erosion of naural deposits
Strontium-90	8 pci/L (DHS)	Increased risk of cancer	Erosion of natural deposits
Tritium	20,000 pCi/L (DHS)	Increased risk of cancer	
Uranium	20 pCi/L (DHS) 0.03 mg/L *effective* 8 Dec 2003	Increased risk of cancer	
		Microorganisms	
Giardia lamblia	TT[c]	Gastrointestinal illness (e.g., diarrhea, vomiting, cramps)	Human and animal fecal waste

Table 2-2 (continued)

Contaminant	MCL[a] or TT[b] (mg/L)	Potential Health Effects from Exposure Above the MCL	Common Sources of Contaminants in Drinking Water
Heterotrophic plate count (HPC)	TT[c]	HPC has no health effects; it is an analytic method used to measure the variety of bacteria that is common in water. The lower the concentration of bacteria in drinking water, the better maintained the water system.	HPC measures a range of bacteria that are naturally present in the environment
Legionella	TT[c]	Legionnaire's Disease, a type of pneumonia[d]	Found naturally in water, multiplies in heating systems
Total Coliforms (including fecal coliform and *E. coli*)	5.0% [e]	Not a health threat in itself; it is used to indicate whether other potentially harmful bacteria may be present.	Total coliforms are naturally present in the environment; fecal coliforms and *E. coli* come from human and animal fecal waste.
Turbidity	TT[c]	Turbidity is a measure of the cloudiness of water. It is used to indicate water quality and filtration effectiveness (e.g., whether disease- causing organisms are present). Higher turbidity levels are often associated with higher levels of disease-causing microorganisms such as viruses, parasites and some bacteria. These organisms can cause symptoms such as nausea, cramps, diarrhea, and associated headaches.	Soil runoff
Viruses (enteric)	TT[c]	Gastrointestinal illness (e.g., diarrhea, vomiting, cramps)	Human and animal fecal waste

[a] Maximum Contaminant Level (MCL) - The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to MCLGs as feasible using the best available treatment technology and taking cost into consideration. MCLs are enforceable standards.

[b] Treatment Technique (TT) - A required process intended to reduce the level of a contaminant in drinking water.

[c] The Surface Water Treatment Rule requires systems using surface water or ground water under the direct influence of surface water to (1) disinfect their water, and (2) filter their water or provide the same level of treatment as those who filter. Treatment must reduce the levels of *Giardia lamblia* (parasite) by 99.9%.and viruses by 99.99%. *Legionella* (bacteria) has no limit, but EPA believes that if *Giardia* and viruses are inactivated, *Legionella* will also be controlled. At no time can turbidity (cloudiness of water) go above 5 nephelometric turbidity units (NTU) [systems that filter must ensure that the turbidity is no higher than 1 NTU (0.5 NTU for conventional or direct filtration) in at least 95% of the daily samples for any single month]; HPC- no more than 500 bacterial colonies per milliliter.

[d] Legionnaire's disease occurs when aerosols containing *Legionella* are inhaled by susceptible persons, not when people drink water containing *Legionella.* Aerosols may come from showers, hot water taps, whirlpools and heat rejection equipment such as cooling towers and air conditioners. Some types of *Legionella* can cause a type of pneumonia called Legionnaire's Disease. *Legionella* can also cause a much less severe disease called Pontiac Fever. The symptoms of Pontiac Fever may include muscle pain, headache, coughing, nausea, dizziness, and other symptoms.

[e] No more than 5.0% of samples may be total coliform-positive in a month. (For water systems that collect fewer than 40 routine samples per month, no more than one sample may be total coliform-positive during a month). Every sample that has total coliforms must be analyzed for either *E. coli* or fecal coliforms to determine whether human or animal fecal matter is present (fecal coliform and *E. coli* are part of the total coliform group).

[f] Fecal coliform and *E. coli* are bacteria whose presence indicates that the water may be contaminated with human in these wastes can cause diarrhea, cramps, nausea, headaches, or other symptoms. These pathogens may pose a special health risk for infants, young children, and people with severely compromised immune systems.

Secondary MCLs, which are set for taste, odor, or appearance of drinking water, are in Title 22 CCR § 64449. Seventeen chemicals or characteristics have secondary MCLs (Table 2-3). Under federal law, secondary MCLs are not enforceable, but California secondary MCLs are enforceable.

Table 2-3 Secondary MCLs

DHS established secondary MCLs for characteristics or constituents and address taste, odor, or appearance of drinking water. Three contaminants have both primary and secondary MCLs: aluminum, MTBE, and thiobencarb.

Chemical or characteristic	Secondary MCL
Aluminum (primary MCL 1 mg/L)	0.2 mg/L
Color	15 units
Copper	1.0 mg/L
Corrosivity	Noncorrosive
Foaming agents (MBAS)	0.5 mg/L
Iron	0.3 mg/L
Manganese	0.05 mg/L
Methyl tertiary butyl ether (MTBE) (primary MCL 0.013 mg/L)	0.005 mg/L
Odor-threshold	3 units
Silver	0.1 mg/L
Thiobencarb (Bolero) (primary MCL 0.07 mg/L)	0.001 mg/L
Turbidity	5 units
Zinc	5.0 mg/L

	Secondary MCL Ranges		
Constituent	Recommended	Upper	Short Term
Total dissolved solids (TDS)	500 mg/L	1000 mg/L	1500 mg/L
Specific conductance	900 µmhos	1600 µmhos	2200 µmhos
Chloride	250 mg/L	500 mg/L	600 mg/L
Sulfate	250 mg/L	500 mg/L	600 mg/L

Table 2-4 Drinking Water Action Levels for DHS Contaminants of Current Interest

These 15 action level contaminants have been detected in and near water supplies, or are otherwise of current interest to the California Department of Health Services. Updated 9 Jan 2001 from www.dhs.ca.gov

Contaminant	Action Level (mg/L)	Number of positives of number sampled (1984 to Nov 2000)
Boron[a]	1	2,002 of 2,685
Perchlorate	0.018[b]	186 of 2,128
Vanadium[a]	0.015	30 of 69
sec-Butylbenzene	0.26	0 of 10,451
tert-Butylbenzene	0.26	1 of 10,449
2-Chlorotoluene	0.14	1 of 10,467
Dichlorodifluoromethane[a]	1	119 of 14,656
1,4-Dioxane	0.003	0 of 116
Isopropylbenzene (Cumene)	0.77	3 of 10,453
Methyl isobutyl ketone (MIBK)	0.12	0 of 10,197
N-Nitrosodimethylamine (NDMA)	0.00002[c]	0 of 1,229
n-Propylbenzene	0.26	2 of 10,454
Tertiary butyl alcohol[a]	0.012	0 of 0
1,2,3-Trichloropropane[a]	0.000005	25 of 10,466
Napthalene	0.017[d]	4 of 10,544

[a] Updated – Chemical is an unregulated chemical requiring monitoring (Title 22 CCR §64450).
[b] Recommended source removal is greater than 0.04 mg/l for perchlorate.
[c] NDMA AL is 10^{-5} risk and source removal requirement recommendation at greater than 0.0002 mg/L, or 10^{-4} risk.
[d] Established in 2000.

DHS has established action levels (ALs), which are based on health advisory levels for contaminants that have no primary MCLs. The ALs are not enforceable standards, but exceeding them prompts statutory requirements and recommendations by DHS for consumer notice. At higher levels, source removal may be recommended. DHS has 44 ALs—15 for contaminants of current interest (Table 2-4) and 29 for contaminants of historic interest (Table 2-5). The current interest ALs are for contaminants that have been detected in or near water supplies, or otherwise of interest to DHS. Historical interest ALs were developed in the 1980s and 1990s but have been rarely detected. They were developed to address potential contamination of drinking water supplies from hazardous wastes or actual cases of spillages or contamination.

As of December 2000, there were 52 unregulated chemicals that were or may have been required to be monitored, depending on the vulnerability of the drinking water source (Title 22 CCR § 64450). They are listed in Table 2-6. MTBE was added to the unregulated monitored chemicals list in 1997, but a secondary MCL was set in January 1999 and a primary MCL was later set in May 2000. There are no drinking water standards for some of the unregulated chemicals.

The detection limits for purposes of reporting (DLRs) are listed in Title 22 CCR § 64432 and § 64445.1. The DLR is the analytical detection level at which DHS is confident about the quantification of the chemical contaminant's presence in drinking water supplies.

Table 2-5 Drinking Water Action Levels for DHS Contaminants of Historical Interest

Historical action levels (ALs) were established in the 1980s and 1990s, but these contaminants have rarely been detected. Generally, these ALs were developed in anticipation of possible contamination sources (for example, hazardous waste site) or actual events (for example, spillages). Updated 9 Jan 2001 from www.dhs.ca.gov

Contaminant	Action Level (mg/L)	Number positives of number sampled (1984 – November 2000)
Aldicarb (Temik)	0.007	0 of 5,243
Aldrin	0.000002	0 of 5,314
Baygon	0.03	0 of 0
a-Benzene Hexachloride (a-BHC)	0.000015	0 of 1,768
b-Benzene Hexachloride (b-BHC)	0.000025	0 of 1,790
n-Butylbenzene	0.07 [a]	2 of 10,401
Captan	0.0015	0 of 1,240
Carbaryl	0.7	0 of 5,456
Chloropicrin	0.050 (0.037)[b]	0 of 1,479
4-Chlorotoluene	0.14	0 of 10,467
Diazinon	0.006	1 of 1,7124
1,2-Dichlorobenzene	0.6 (0.010)[c]	2 of 14,681
1,3-Dichlorobenzene	0.6 (0.010)[c]	3 of 14,681
Dieldrin	0.000002	0 of 4,988
Dimethoate	0.001	0 of 6,263
2,4-Dimethylphenol	0.1	0 of 1,184
Diphenamide	0.2	0 of 1,184
Ethion	0.004	0 of 583
Formaldehyde	0.1	0 of 16
Isopropyl-N-(3-chlorophenyl) carbamate	0.035	0 of 0
Malathion	0.16	0 of 915
N-Methyl dithiocarbamate (Metam sodium)	0.02[d]	0 of 0
Methylisothiocyanate (MITC)	0.05[d]	0 of 0
Methyl parathion	0.002	0 of 540
Parathion	0.04	0 of 1,485
Pentachloronitrobenzene	0.02	0 of 0
Phenol	4.2 (0.005)[e]	0 of 1,191
2,3,5,6-Tetrachloroterephthalate	3.5	0 of 0
Trithion	0.007	0 0f 0

[a] Revised from 0.045 in 2000.
[b] Taste and odor threshold.
[c] Taste and odor threshold either for a single isomer or the sum of 2 isomers.
[d] Calculated by using standard risk assessment methods but using the child as the endpoint of concern (10 kg body weight, 1 liter per day DWC) and 1.0 RSC.
[e] Taste and odor threshold for chlorinated systems.

Table 2-6 California DHS Unregulated Chemicals Requiring Monitoring, Prior to 3 Jan 2001

List A Unregulated Organic Chemicals

Chemical	Synonym
Bromobenzene	Monobromobenzene
Bromodichloromethane	Dichlorobromomethane
Bromoform	Tribromomethane
Bromomethane	Methyl Bromide
Chlorodibromomethane	Dibromochloromethane
Chloroethane	Ethyl Chloride
Chloroform	Trichloromethane
Chloromethane	Methyl Chloride
2-Chlorotoluene	0-Chlorotoluene
4-Chlorotoluene	p-Chlorotoluene
Dibromomethane	Methylene Bromide
1,3-Dichlorobenzene	m-Dichlorobenzene
Dichlorodifluoromethane	Difluorodichloromethane
1,3-Dichloropropane	
2,2-Dichloropropane	
1,2-Dichloropropene	
1,1,1,2-Tetrachloroethane	
1,2,3-Trichloropropane	Allyl Trichloride

List B Unregulated Organic Chemicals

Chemical	Synonym
Bromacil	HYVAR X, HYVAR XL
Bromochloromethane	Chlorobromomethane
n-Butylbenzene	1-Phenylbutane
Sec-Butylbenzene	2-Phenylbutane
Tert-Butylbenzene	2-Methyl-2-phenylpropane
Chlorothalonil	BRAVO
Dimethoate	CYGON
Diuron	KARMEX, KROVAR
Ethyl-tert-butyl ether	ETBE
Hexachlorobutadienne	Perchlorobutadiene
Isopropylbenzene	Cumene
p-Isopropylbenzene	p-Cymene
Methyl-tert-butyl ether[a]	MTBE
Napthalene	Napthalin
1-Phenylpropane	n-Propylbenzene
Prometryn	CAPAROL
Tert-Amyl-methyl ether	TAME
1,2,3-Trichlorobenzene	Vis Trichlorobenzene
1,2,4-Trimethylbenzene	Pseudocumene
1,2,5-Trimethylbenzene	Mesitylene

Source: 1 Jan 2000, 7th edition, Title 22 of the California Code of Regulations, Tables 64450-A,B,C,D

[a] Monitoring required only for nontransient-noncommunity water systems.

List C Unregulated Organic Chemicals

Chemical	Synonyms
Aldicarb	
Aldicarb sulfone	
Aldicarb sulfoxide	
Aldrin	Aldrec, Aldron
Butachlor	Butanex, Lambast, Machete
Carbaryl	Sevin
Dicamba	Banex, Banvel, Dianat
Dieldrin	
3-Hydroxycarbofuran	
Methomyl	Lannate
Metolachlor	Metelilachlor
Metribuzin	Lexone, Sencor, Sencoral
Propachlor	Albrass, Ramrod

List D Unregulated Inorganic Chemical

Chemical	Synonym
Perchlorate	

Community and nontransient-noncommunity water systems shall monitor for the unregulated chemicals at 5-year intervals by collecting source water samples, or samples from the distribution entry points which are representative of typical operating conditions. For chemicals in Tables 64450-A and 64450-B, surface water systems shall collect 1 year of quarterly samples at each sampling site and groundwater systems shall collect a minimum of 1 sample per sampling site. For chemicals in Tables 64450-C and 64450-D, both surface and groundwater systems shall collect 4 consecutive quarterly samples at each sampling site. For the chemicals ETBE, TAME, and perchlorate, systems may use monitoring data collected any time after 1 January 1993 for sampling sites to meet the initial monitoring requirements. For additional requirements and updates, refer to the latest Title 22 Code of Regulations.

2.1.2 TOTAL COLIFORM RULE

The 1986-amended SDWA required EPA to review the existing standard for total coliform bacteria. EPA reexamined the standard and in November 1987 proposed a new rule. The Total Coliform Rule (TCR) became final in June 1989 and effective 31 December 1990. The rule sets a maximum contaminant level goal (MCLG) for total coliform (including fecal coliform and *E. coli)* of zero and an MCL based on the presence or absence of total coliforms. Monitoring requirements relative to number of monthly samples are based on population served by a community system. For systems that analyze fewer than 40 samples per month, no more than 1 sample per month may be positive for total coliforms.

Routine samples are to be collected from drinking water taps at regular time intervals throughout the month. If a routine sample is positive for total coliforms, the water system must collect a set of repeat samples (3 samples) within 24 hours of being notified of the positive sample:

- One of the repeat samples must be from the same tap as the positive sample,
- One repeat sample must be from a site within 5 service connections upstream of the positive site, and
- One repeat sample must be within 5 service connections downstream of the positive site.

If 1 or more of the repeat samples is coliform-positive, the utility must collect an additional set of repeat samples. All repeat samples are to be collected on the same day. The system operator must repeat this process until no coliforms are detected or be in violation of the coliform rule.

Routine or repeat coliform-positive samples must be analyzed for the presence of fecal coliforms and/or *E. coli*. A laboratory must notify the water system operator within 24 hours after the presence of total coliforms, fecal coliforms or *E. coli* is demonstrated or after a sample is invalidated because of interference problems.

The federal TCR is found in the California Code of Regulations under Title 22, Chapter 15, Article 3. Water system operators were to develop and submit to DHS a sample siting plan for coliform bacteria by 1 September 1992. The sample sites must be representative of water throughout the distribution system, including all pressure zones, and areas supplied by each water source and distribution reservoirs. An updated plan must be submitted to DHS every 10 years. If a system has identified more sample locations than is required, the system can rotate sampling among these sites. California regulations do not state that sample siting plans must be approved by DHS.

- The MCL for total coliforms is as follows:
- For a system collecting more than 40 samples per month, no more than 5.0% of the collected samples may be total coliform-positive.
- For systems collecting fewer than 40 samples per month, a nonacute violation occurs when there is more than 1 positive coliform sample in a given month.

A fecal coliform-positive repeat sample or *E. coli*-positive repeat sample or a total coliform-positive repeat sample, following a fecal coliform or *E. coli*-positive routine sample, constitutes an acute violation of the MCL for total coliforms.

If a system exceeds the MCL for total coliforms, the system operator must notify DHS by the end of the business day when the violation was determined. If the determination is made after the DHS offices close, notification must be made within 24 hours and the system operator must give public notification.

If DHS notifies a system operator that there has been a "significant rise in bacterial count," the system operator must implement an emergency notification plan. California drinking water regulations define a significant rise in bacterial count as ". . . an increase in coliform bacteria . . . when associated with a suspected waterborne illness or disruption of physical works or operating procedures." These State regulations list 3 criteria that could indicate a "significant rise in bacterial count":

1) A system collecting at least 40 samples per month has a total coliform-positive routine sample followed by 2 total coliform-positive samples in the repeat sample set; or
2) A system has a sample that is positive for fecal coliform or *E. coli*; or
3) A system fails the total coliform MCL.

If any of the above criteria exist, the system operator must contact the State by the end of the day or within 24 hours of the result indicating the system exceeded the MCL. The system operator also must submit to DHS information on the current status of the physical works and operating procedures that may have caused the elevated level of bacteria.

A surface water system, or a groundwater system under the influence of surface water, not practicing filtration in compliance with the Surface Water Treatment Rule (SWTR), must collect at least 1 sample near the 1st service connection each day turbidity level of the source water exceeds 1 NTU.

A water system operator can apply for a variance from the total coliform MCL. California regulations include specific criteria to determine if an MCL violation is due to a persistent growth of total

coliforms in the distribution system rather than to fecal or pathogenic contamination, a treatment lapse or deficiency, or a problem in the operation or maintenance of the distribution system. California regulations provide criteria a system must meet in order to receive a variance because of coliform regrowth in the distribution system.

2.1.3 SURFACE WATER TREATMENT RULE

The general requirements of the SWTR are to provide treatment to ensure at least " . . . 99.9% (3-log) removal and/or inactivation of *Giardia lamblia* cysts . . . " and at least ". . . 99.99% (4-log) removal and/or inactivation of viruses."

Under the federal SWTR, filtering systems must meet several specific requirements for disinfection and turbidity. Following are the turbidity requirements for conventional filtration systems:

- "The turbidity of representative samples of a system's filtered water must be less than or equal to 0.5 NTU in at least 95% of the measurements taken each month. . . . except that if the State determines that the system is capable of achieving at least 99.9% removal and/or inactivation of *Giardia lamblia* cysts at some turbidity level higher than 0.5 NTU."
- "The turbidity level of representative samples of a system's filtered water must at no time exceed *5* NTU. . . ."

Turbidity measurements are to be performed on representative samples of the system's filtered water every 4 hours (or more frequently). Continuous monitoring can be substituted for grab sampling, if the system validates the continuous measurement for accuracy on a regular basis. Following are the federal SWTR disinfection requirements for systems that filter:

- "The disinfection treatment must be sufficient to ensure that the total treatment processes of that system achieve at least 99.9% (3-log) inactivation and/or removal of Giardia lamblia cysts and at least 99.99% (4-log) inactivation and/or removal of viruses, as determined by the State."
- "The residual disinfectant concentration in the water entering the distribution system . . . cannot be less than 0.2 mg/L for more than 4 hours."
- "The residual disinfectant concentration in the distribution system, measured as total chlorine, combined chlorine, or chlorine dioxide, as specified in 141.74(a)(5) and (c)(3), cannot be undetectable in more than 5% of the samples each month, for any 2 consecutive months that the system serves water to the public. Water in the distribution system with a heterotrophic bacteria concentration less than or equal to 500/mL, measured as heterotrophic plate count (HPC) . . . is deemed to have a detectable disinfectant residual for purposes of determining compliance with this requirement."

The lowest value of disinfectant residual entering the distribution system shall be recorded each day. The residual disinfectant concentration shall be measured at the same points and at the same time that total coliforms are sampled.

The California SWTR is much more detailed and prescriptive than the federal SWTR. To meet the basic 3-log *Giardia* and 4-log virus reduction requirements, utilities must meet the filtration and disinfection performance standards described above. The California SWTR provides design standards for new treatment plants or modifications to existing treatment plants that require permit approval. These design standards include an average daily effluent turbidity goal of 0.2 NTU when using conventional, direct, and diatomaceous earth filtration, provision of filter-to-waste or addition of coagulant chemical to water used for backwashing, among other provisions. System operators must also provide reliability features such as alarm devices, standby replacement equipment, continuous turbidity monitoring, and multiple filter units to replace filter units that fail or are out of service.

The California SWTR also provides maximum flow rates for different filtration treatment plants. DHS can approve higher flow rates if a system demonstrates it can continue to meet SWTR performance requirements at the higher flow rates. When any individual filter in a conventional or direct filtration plant is returned to service following backwashing (or other interruption), the filtered water from that filter shall not exceed any of the following:

- 2.0 NTU;
- 1.0 NTU in at least 90% of the interruption events during any 12-month period; or
- 0.5 NTU after the filter has been in operation for at least 4 hours.

Coagulation and flocculation unit processes are to be used at all times when conventional or direct filtration plants are in operation. The effectiveness of these processes is to be demonstrated by either: at least an 80% reduction through the filters of the monthly average raw water turbidity; or jar testing, pilot testing, or other means to demonstrate that optimum coagulation is being achieved.

Utilities are required to have a DHS-approved operations plan and must report to DHS within 24 hours after any of the following occurs:

- Turbidity of combined filter effluent exceeds 5.0 NTUs at any time;
- More than 2 consecutive turbidity samples of combined filter effluent taken every 4 hours exceeds 1.0 NTU;
- A failure to maintain the 0.2 mg/L disinfectant residual in water being delivered to distribution system (and whether the residual level was restored within 4 hours); or
- An event that could affect the ability of the treatment plant to produce safe, potable water (including, but not limited to spills of hazardous materials and unit treatment process failures).

2.2 RECENT AND PROPOSED RULES

The following information includes updates as of February 2001.

2.2.1 ARSENIC RULE

The SDWA requires EPA to revise the existing 50 parts per billion (ppb) standard for arsenic in drinking water. In January 2001, EPA published a new standard for arsenic in drinking water that would require public water supplies to reduce arsenic to 10 ppb by 2006. EPA is reviewing this standard so that communities that need to reduce arsenic in drinking water can proceed with confidence that the new standard is based on sound science and accurate cost and benefit estimates.

On 19 July 2001, EPA issued a proposal to request comment on whether data and technical analyses associated with the January 2001 arsenic rule support setting the arsenic standard at 3 ppb, 5 ppb, 10 ppb, or 20 ppb. In addition, the agency asks commenters to submit new information for review. The July 2001 notice summarizes 1) the January 2001 arsenic regulations; 2) changes to the effective date; 3) ongoing analyses of health data, cost of compliance estimates, and benefits; and 4) the review of small system implementation issues, including affordability, availability of financial assistance, treatment options, and extended compliance schedules. In fall 2001, EPA is to publish another notice requesting public comment on the reviews that are under way.

The Final Rule for Arsenic in Drinking Water revised the current MCL from 50 µg/L to 10 µg/L and set an MCLG of zero for arsenic in drinking water (EPA 2001). In addition, the rule clarified how compliance is demonstrated for many inorganic and organic contaminants in drinking water.

Both community water systems (CWSs) and nontransient, noncommunity water systems (NTNCWSs) will be required to reduce the arsenic concentration in their drinking water systems to the new MCL. A CWS is a public water system that serves at least 15 locations or 25 residents regularly year round, for example, most cities and towns, apartments, and mobile home parks with their own water supplies. A NTNCWS is a public water system that is not a CWS and serves at least 25 of the same people more than 6 months of the year, for example, schools, churches, nursing homes, and factories.

This final rule also clarified 2 compliance requirements for inorganic contaminants (IOCs), volatile organic contaminants (VOCs), and synthetic organic contaminants (SOCs). When a system fails to collect the required number of samples, compliance averages will be based on the actual number of samples collected. Also, new public water systems and systems using new sources of water must demonstrate compliance within State-specified time and sampling frequencies.

All CWSs and all NTNCWSs that exceed the new MCL will be required to come into compliance by 22 January 2006. Beginning with reports that are due as specified in the new rule, all CWSs will begin providing health information and arsenic concentrations in their annual consumer confidence report (CCR) for water that exceeds one-half of the new MCL.

There has been 2 extensions for the arsenic rule's effective date. In accordance with the 20 January 2001 memorandum from Andrew Card, assistant to the President and Chief of Staff, titled "Regulatory Review Plan," EPA temporarily delayed the effective date for this rule for 60 days, from 23 March 2001 until 22 May 2001. The delay of the effective date was published 23 March 2001. On 23 April, EPA requested public comment on a proposal to delay the effective date for the rule until 22 February 2002. On 22 May, EPA announced that it would delay the effective date for the rule until 22 February 2002, allowing time to complete the reassessment process outlined above and to give the public a full opportunity to provide input.

2.2.2 STAGE 1 DISINFECTANTS AND DISINFECTION BYPRODUCT RULE

In addition to meeting national and State MCLs for treated drinking water, SWP water utilities that use Sacramento/San Joaquin Delta water are concerned about several source water constituents in their water supplies. The Delta is a tidally influenced estuary that is subject to seawater intrusion. It also receives large amounts of agricultural drainage, natural and urban runoff, and municipal wastewater discharges.

Delta source water is high in bromide and total organic carbon (TOC) compared to other drinking water sources.

This poses significant challenges to water utilities in meeting drinking water standards for disinfection byproducts (DBPs) such as trihalomethanes and bromate, depending on the treatment method.

The disinfectants themselves can react with naturally occurring materials in the water to form unintended byproducts that may pose human health risks. Some pathogens, like *Cryptosporidium*, are resistant to traditional disinfection practices. Amendments in 1996 to the SDWA require EPA to develop rules to balance the risks between microbial pathogens and DBPs. The Stage 1 Disinfectants and Disinfection Byproducts (D/DBP) Rule and Interim Enhanced Surface Water Treatment Rule (IESWTR) were announced in December 1998.

The Stage 1 D/DBP Rule applies to all community water systems and NTNCWSs that treat water with a chemical disinfectant for either primary or residual treatment. The rule (Table 2-7) sets maximum residual disinfectant level goals (MRDLGs) and maximum residual disinfectant levels (MRDLs) for 3 chemical disinfectants: chlorine, chloramine, and chlorine dioxide. It also establishes MCLGs and MCLs for total trihalomethanes, haloacetic acids, chlorite and bromate.

Table 2-7 Stage 1 Disinfectants and Disinfection Byproducts Rule Maximum Levels

Updated 26 April 2000 from www.epa.gov/safewater/mdpb/dbp1.html

Disinfectant Residual	MRDLG[a] (mg/L)	MRDL[b] (mg/L)	Compliance based on
Chlorine	4 (as Cl_2)	4.0 (as Cl_2)	Annual average
Chloramine	4 (asCl_2)	4.0 (as Cl_2)	Annual average
Chlorine dioxide	0.8 (as ClO_2)	0.8 (as ClO_2)	Daily samples
Disinfection Byproducts	**MCLG (mg/L)**	**MCL (mg/L)**	**Compliance based on**
Total trihalomethane (TTHM)[c]	N/A	0.080	Annual average
Chloroform			
Bromodichloromethane	0		
Dibromochloromethane	0		
Bromoform	0.06		
Haloacetic acids (five) (HAA5)[d]	N/A	0.060	Annual average
Dichloroacetic acid	0		
Trichloroacetic acid	0.3		
Chlorite	0.8	1.0	Monthly average
Bromate	0	0.010	Annual average

[a] Maximum residual disinfectant level goal.
[b] Maximum residual disinfectant level.
[c] TTHM is sum concentration of chloroform, bromodichloromethane, dibromochloromethane, and bromoform.
[d] HAA5 is the sum concentration of mono-,di-, and trichloroacetic acids and mono- and dibromoacetic acids.

Table 2-8 Required Total Organic Carbon Removal by Enhanced Coagulation and Enhanced Softening[a]

Source Water TOC (mg/L)	Source Water Alkalinity (mg/L as $CaCO_3$)		
	0 – 60	> 60 – 120	> 120 [b]
> 2.0 – 4.0	35.0%	25.0%	15.0%
> 4.0 – 8.0	45.0%	35.0%	25.0%
> 8.0	50.0%	40.0%	30.0%

[a] Systems meeting at least 1 of the alternative compliance criteria in the rule are not required to meet removals in this table.

[b] Systems practicing softening must meet the TOC removal requirement in the last column to the right.

In addition, water systems that use surface or groundwater under the direct influence of surface water and use conventional treatment are required to remove specified percentages of TOC prior to adding disinfectants (Table 2-8). Removal to be achieved through a treatment technique (enhanced softening or coagulation) unless the water system meets alternative criteria. On 16 January 2001, the EPA officially revised the compliance date for large surface water public water systems (PWSs) to meet the Stage 1 D/DBP Rule and IESWTR from December 2001 to January 2002.

2.2.3 LONG TERM 1 ENHANCED SURFACE WATER TREATMENT RULE

Primary purposes of IESWTR are to improve microbial control, especially *Cryptosporidium*, and guard against microbial risk because of the Stage 1 D/DBP Rule. The final IESWTR provisions include the following:

- MCLG of zero for *Cryptosporidium*;
- 2-log *Cryptosporidium* removal requirements for systems that filter;
- Strengthened performance standards and individual filter turbidity monitoring provisions;
- Disinfection benchmark provisions to assure continued levels of microbial protection while facilities take necessary steps to comply with new disinfection byproduct standards;
- Inclusion of *Crytosporidium* in the definition of groundwater under direct influence (GWUDI) of surface water and additional avoidance criteria for unfiltered public water systems;
- Requirements for covers on new finished water reservoirs; and
- Sanitary surveys for all surface water and GWUDI systems regardless of size.

The IESWTR provisions apply to PWSs that use surface water or GWUDI and serve 10,000 or more people, except in primacy states such as California, sanitary surveys are required for all surface water and GWUDI systems regardless of size.

2.2.4 PROPOSED SULFATE RULE

Sulfate is naturally found in drinking water. There are health concerns because diarrhea may be associated with the ingestion of water containing high levels of sulfate. Also, there are population groups that may be at greater risk from the laxative effects of sulfate when they experience an abrupt change from drinking water with low sulfate concentrations to drinking water with higher sulfate concentration (www.epa.gov/safewater/sulfate.html; updated 1 December 2000).

Sulfate in drinking water has a secondary (MCL) of 250 milligrams per liter (mg/L), based on taste and odor. This regulation is not a federally enforceable standard but is provided as a guideline for states and PWSs. EPA estimates that about 3% of the public drinking water systems in the country may have sulfate levels of 250 mg/L or greater. The SDWA, as amended in 1996, directs the EPA and the Centers for Disease Control and Prevention (CDC) to jointly conduct a study to establish a reliable dose-response relationship for the adverse human health effects from exposure to sulfate in drinking water, including the health effects that may be experienced by sensitive subpopulations, for example, infants and travelers. SDWA specifies that the study be based on the best available peer-reviewed science and supporting studies, conducted in consultation with interested states, and completed in February 1999.

Sulfate is 1 of the 50 chemical and 10 microbiological contaminants/contaminant groups included on the Drinking Water Contaminant Candidate List (EPA 1998). SDWA, Section 1412 (b)(12)(B)(ii), directs EPA to include sulfate among the 5 or more contaminants that the agency is to determine by August 2001 whether to regulate. Before making its decision, EPA will evaluate the contaminant candidate list and the National Primary Drinking Water Regulations (NPDWR), analyzing all public comments, reviewing all comments on its previously proposed NPDWR for sulfate (EPA 1994), and reviewing any other information that could have a bearing on its decision of whether to regulate sulfate under NPDWR. In so doing, EPA will be evaluating whether or not the statutory tests provided in Section 1412(b)(1)(A) of SDWA for proceeding with such regulation are met:

> "The contaminant may have an adverse effect on the health of persons; the contaminant

is known to occur or there is a substantial likelihood that the contaminant will occur in public water systems with a frequency and at levels of public health concern; and in the sole judgment of the Administrator, regulation of such contaminant presents a meaningful opportunity for health risk reduction for persons served by public water systems."

In making this determination, EPA will review—in addition to the dose-response data and information described in the *Federal Register*—a host of applicable risk management factors. They include but are not limited to occurrence data on concentrations of sulfate in PWSs, information relative to treatment technologies (particularly, technologies applicable to small PWSs), availability and costs of analytical methods for sulfate, and overall costs and benefits attributable to any likely rule.

2.2.5 PROPOSED RADON RULE

The EPA is proposing new regulations to protect people from exposure to radon <http://www.epa.gov/OGWDW/radon/fact.html>. The proposed regulations will provide states with flexibility in limiting the public's exposure to radon by allowing the states to focus their efforts on the greatest public health risks from radon—those in indoor air—while reducing the highest risks from radon in drinking water. The framework for this proposal is set out in the SDWA as amended in 1996.

The SDWA directs the EPA to propose and finalize an MCL for radon in drinking water, but also to make available an alternative approach—a higher alternative MCL accompanied by a multimedia mitigation (MMM) program to address radon risks in indoor air. This framework reflects the unique characteristics of radon. In most cases, radon released into indoor air from soil under homes and buildings is the main source of exposure, and radon released from tap water is a much smaller source of radon in indoor air. It is generally more cost-effective to reduce risk from radon exposure from indoor air than from drinking water. EPA strongly encourages states to take full advantage of the flexibility and risk reduction opportunities in the MMM program.

Based on a second 1999 National Academy of Science report on radon in drinking water, EPA estimates that radon in drinking water causes about 168 cancer deaths per year—89% from lung cancer caused by breathing radon released from water, and 11% from stomach cancer caused by drinking radon-containing water.

The proposed radon in drinking water rule applies to all community water systems that use groundwater or mixed ground and surface water, for example, systems serving homes, apartments, and trailer parks. The proposed rule would not apply to CWSs that use solely surface water nor to NTNCWSs or transient public water supplies, for example, systems serving schools, office buildings, campgrounds, restaurants, and highway rest stops.

The rule proposes an MCLG, an MCL, an alternative MCL, and requirements for an MMM program to address radon in indoor air. The proposed rule includes monitoring, reporting, public notification and consumer confidence report requirements and specifies best available technologies and analytical methods.

The proposed MCLG for radon in drinking water is zero. This is a non-enforceable goal. The proposed regulation provides 2 options for the maximum level of radon allowable in CWSs: an MCL of 300 picocuries per liter (pCi/L) or an alternative MCL of 4,000 pCi/L. The drinking water standard that would apply for a system depends on whether the State or the CWS develops an MMM program. CWSs that serve 10,000 or fewer customers have a regulatory expectation to meet the 4,000 pCi/L alternative MCL and be associated with an approved MMM program plan, developed either by the State or the CWS.

2.2.6 UNREGULATED CONTAMINANT MONITORING RULE

In 1996 the SDWA was amended with the Unregulated Contaminant Monitoring Rule (UCMR). The rule requires EPA to establish criteria for a monitoring program for unregulated contaminants and to publish a list of contaminants to be monitored. The list has undergone extensive review and prioritization of a Drinking Water Contaminant Candidate List. The UCMR stipulates the following:

- A list of contaminants for which PWSs must monitor;
- Specific analytical methods to be used;
- Requirements for all large PWSs, and a representative sample of small PWS, to monitor for the listed contaminants with the promulgated methods;
- Submission of the monitoring data to EPA and the states for inclusion in the national Drinking Water Contaminant Occurrence Database; and
- Notification to consumers of the monitoring results.

Table 2-9 Unregulated Contaminant Monitoring Rule Lists

List 1 Assessment Monitoring of Contaminants with Available Methods	List 2 Screening Survey of Contaminants Projected to have Methods by Date of Program Implementation	List 3 Pre-Screen Testing of Contaminants Needing Research on Methods
2,4-dinitrotoluene	Diuron	Cyanobacteria (blue-green algae, other freshwater algae and their toxins)
2,6-dinitrotoluene	Linuron	Echoviruses
Acetochlor	Prometon	Coxsackieviruses
DCPA mono-acid degradate	2,4,6-trichlorophenol	Heliobacter pylori
DCPA di-acid degradate	2,4-dichlorophenol	Mirosporidia
4,4'-DDE	2,4-dinitrophenol	Calciviruses
EPTC	2-methyl-phenol	Adenoviruses
Molinate	Alachlor ESA	Polonium-210
MTBE	1,2-diphenylhydrazine	Lead-210
Nitrobenzene	Diazinon	
Perchlorate	Disulfoton	
Terbacil	Fonofos	
	Tebufos	
	Aeromonas	
	RDX	
	Nitrobenzene	

Source: Update 22 Jan 2001 from www.usepa.gov/safewater/ucmr.html

The UCMR list includes 35 contaminants, which were identified as occurrence priorities on the contaminant candidate list, and 2 radionuclides that emerged during development of the regulations. The UCMR list is divided into 3 lists based on the readiness of analytical methods and current contaminant occurrence data (Table 2-9).

List 1 for assessment monitoring includes 12 chemical contaminants for which analytical methods exist. List 1 monitoring will occur at large PWSs and a representative sample of small PWS beginning in 2001. Surface water systems will monitor quarterly for 1 year and groundwater systems twice per year. List 2 for screening survey will occur at small PWSs selected for the screening survey one in 2001 and at large PWSs selected for screening survey one in 2002. On 11 January 2001, EPA finalized analytical methods for 13 (of the original 16) of the List 2 screening survey contaminants to be monitored and the monitoring schedule for the microbiological contaminant, *Aeromonas* (2003 if the analytical method is promulgated in 2001). The rule also finalizes minor changes to the September 1999 UCMR that affect the implementation of monitoring for List 1 and List 2 contaminants. List 3 for prescreen testing are contaminants that recently have become of concern. Methods for the detection of these contaminants are in the early stages of development. List 3 contaminants will be monitored only after future rulemaking specifies methods to determine whether a listed contaminant occurs frequently in most vulnerable water systems or sampling locations to warrant inclusion in future assessment monitoring or screening surveys.

The monitoring of unregulated contaminants by PWSs informs the public about pollutants not previously measured. This data will help determine if a contaminant frequently occurs and at what levels to warrant further action, which may include more analysis and research on potential health effects and regulation. The major benefit of monitoring unregulated contaminants is early warning of their presence before serious health effects occur.

While the UCMR list contains 35 contaminants, under the SDWA 1996 amendment, EPA is limited to having 30 contaminants monitored in any 5-year cycle. The success of developing analytical methods will determine which 30 contaminants will be monitored in the 5-year cycle.

2.2.7 RADIONUCLIDES (NONRADON) RULE

EPA promulgated the final drinking water standards for (nonradon) radionuclides in drinking water: combined radium-226/-228, (adjusted) gross alpha, beta particle and photon radioactivity, and uranium. This promulgation consisted of revisions to the 1976 rule, as proposed in 1991 (www.epa.gov/safewater/radionuc.html). The standards are: combined radium 226/228 (5 pCi/L); beta emitters (4 mrems); gross alpha standard (15 pCi/L); and uranium (30 µg/L).

CWSs are water systems that serve at least 15 service connections or 25 residents regularly year round. They are required to meet the final MCLs and to meet the requirements for monitoring and reporting. NTNCWS are public water systems that are not a CWS and serve at least 25 of the same people more than 6 months per year, for example, schools and nursing homes. NTNCWS will not be regulated at this time, but EPA will consider this matter and may propose to regulate radionuclides at NTNCWSs in the future. The final rule requires that all new monitoring be conducted at each entry point to the distribution system under a schedule designed to be consistent with the Standardized Monitoring Framework. The framework was promulgated by EPA under the Phase II Rule of the NPDWR and revised under Phase IIB (1991) and Phase V (1992). The framework's goal is to streamline the drinking water monitoring requirements by standardizing them within contaminant groups and by synchronizing monitoring schedules across contaminant groups. The Draft Implementation Guidance for Radionuclides, which details the proposed monitoring requirements, was published in December 2000 (EPA 816-A-00-002).

The rule will become effective 8 December 2003, 3 years after the publication date (7 December 2000). New monitoring requirements will be phased-in between that date and the beginning of the next Standardized Monitoring Framework period, 31 December 2007. "Phased-in monitoring" refers to the requirement by states that some fraction of water systems complete initial monitoring requirements each year between the effective date (8 December 2003) and the beginning of the new cycle (31 December 2007). Water systems will determine initial compliance under the new monitoring requirements using the average of 4 quarterly samples or, at State discretion, using appropriate grandfathered data.

Compliance will be determined immediately based on the annual average of the quarterly samples for that fraction of systems required by the state to monitor in any given year or based on the results from the grandfathered data. Water systems with existing radionuclides monitoring data demonstrating that the system is out of compliance with new provisions will be out of compliance on the effective date of 8 December 2003. Water systems with existing data that demonstrate noncompliance with the current (1976) rule are in violation of the radionuclides National Primary Drinking Water Regulations.

2.2.8 REVISED DHS UNREGULATED CHEMICALS REQUIRING MONITORING

On 3 January 2001, DHS reduced the number of unregulated chemicals requiring monitoring from 52 to 9. The list is presented in Table 2-10. Chromium VI was included among the 9 listed contaminants.

Table 2-10 Revised California DHS Unregulated Chemicals Requiring Monitoring List [a]

Chemical	Number positive sources of number sources sampled from 1984–Nov 2000
Boron [b]	2,000 of 2,685
Chromium VI (Hexavalent chromium)[c]	
Dichlorodifluoromethane (Difluorodichloromethane)[b]	119 of 14,656
Ethyl tertiary butyl ether (ETBE)	0 of 2,083
Perchlorate	186 of 2,128
Tertiary amyl methyl ether (TAME)	0 of 2,997
Tertiary butyl alcohol (TBA) [b]	
1,2,3-Trichloropropane (TCP) [b]	25 of 10,466
Vanadium [b]	30 of 69

Source: Updated 13 Feb 2001 from www.dhs.ca.gov/ps/ddwem/chemicals/MCL/unregulated.htm

[a] Effective as of 3 Jan 2001.

[b] Chemical has a DHS action level.

[c] Chromium VI is regulated under the MCL for total chromium

2.2.9 DHS REVIEW OF MCLS FOR 13 CONTAMINANTS

The CalEPA Office of Environmental Health Hazard Assessment (OEHHA) establishes public health goals (PHGs). PHGs are concentrations of drinking water contaminants that OEHHA considers nonsignificant health risks if consumed for a lifetime.

PHGs are determined strictly from health risk assessment principles, practices, and methods. A PHG is not a drinking water standard but rather a

health protective goal to be considered relative to MCLs that may be revised or established. MCLs are health-protective drinking water standards that are adopted by DHS and must be met by PWSs. An MCL is developed from risk management determinations that consider a chemical's health risks, detectability, treatability, and cost of treatment. Health and Safety Code § 16365(a) requires DHS to establish a contaminant's MCL at a level as close as is technically and economically feasible to its PHG, placing primary emphasis on protecting public health.

OEHHA is required to set PHGs for contaminants with MCLs and those contaminants for which DHS intends to adopt MCLs. Each PHG is reviewed and revised at least once every 5 years as necessary, based upon available scientific information. Once OEHHA sets or revises a PHG, DHS determines whether a contaminant's MCL should be reviewed.

DHS has been reviewing MCLs for 13 contaminants. The review process began with an initial screening. The criteria for the screening included the following:

- The relationship between the PHG and both the federal and State MCLs;
- Any changes in treatment techniques for chemical removal that would provide for a materially greater protection of public health; and
- Any new scientific evidence indicating that the substance might present a materially different risk to public health than was previously determined.

In 2 separate lists in 1998 and 1999, DHS designated the following 13 chemicals for a more comprehensive review: cyanide, ethylbenzene, oxamyl, di(2-ethylhexyl)phthalate (DEHP), atrazine, cadmium, chromium, dibromochloropropane (DBCP), 1,2-dichloropropane, methoxychlor, thallium, 1,2,4-trichlorobenzene, and 1,1,2-trichloroethylene (TCE).

The most recent 4 years of analytical data were obtained from DHS' Water Quality Monitoring (WQM) database and analyzed for each chemical to assess chemical occurrence in drinking water sources for the MCL reviews.

DHS established a standardized reporting (quantification) level called the "detection level for purposes of reporting" (DLR) for each chemical in the WQM program. The DLR represents the level at which DHS is confident about the accuracy of the quantity of contaminant being reported. Although any findings below DLRs are considered nondetects and technically are not required to be reported, some laboratories do report lower levels for chemicals.

In the MCL reviews, DHS chose to use the reported values in WQM, regardless of whether or not the values exceeded the DLR. DHS is working with some analytical laboratories participating in a "reporting level workgroup" to evaluate whether any of the existing DLRs should be revised, and, if so, how this should be accomplished. For some chemicals, the DLR may affect the feasibility of revising the MCL.

An update of the MCL reviews for the 13 contaminants designated for MCL review in DHS's 1998 and 1999 lists are presented in Table 2-11. Eight MCL reviews have been completed. DHS has recommended:

- Revising downward the MCLs for 6 contaminants: atrazine, cyanide, ethylbenzene, methoxychlor, oxamyl, and 1,2,4-trichlorobenzene; and
- Not changing the MCLs for 2 contaminants: DEHP and DBCP.

Two contaminants, cadmium and thallium, are undergoing DLR evaluations. Two other contaminants, 1,2-Dichloropropane and TCE, are undergoing comprehensive cost-benefit analyses.

Table 2-11 Status of DHS Reviews of MCLs for 13 Contaminants

Contaminant	MCL, PHG, DLR (μg/L)	DHS Recommendations	Status of review action
Atrazine	DHS/EPA MCL 3 PHG 0.15 DLR 1	MCL 1 DLR 0.5	
Cadmium	DHS/EPA MCL 5 PHG 0.07 DLR 1		Awaiting completion of DLR study
Chromium Total, Cr+3, Cr+6	EPA MCL 100 total Cr DHS MCL 50 total Cr PHG 2.5 total Cr DLR 10 for total Cr	Cr+6 Required unregulated chemical for monitoring until more data are available for review	Monitoring requirement effective 3 Jan 2001
Cyanide	DHS/EPA MCL 200 PHG 150 DLR 1	DHS MCL 150	Revised MCL proposed
Dicbromochloropropane (DBCP)	DHS MCL 0.2 PHG 0.0017	No revision due to high cost-to-benefit ratio	Responses posted for public comment in May-June 2000
1,2-Dichloropropane	DHS/EPA MCL 5 PHG 0.5 DLR 0.5		Analysis of data ongoing
Di(2-Ethylhexyl) Phthalate(DEHP)	DHS MCL 4 EPA MCL 6 PHG 12	No revision	
Ethylbenzene	DHS/EPA MCL 700 PHG 300	DHS MCL 300	Revised MCL proposed
Methoxychlor	DHS/EPA MCL 40 PHG 30	DHS MCL 30	Revised MCL proposed
Oxamyl	DHS/EPA MCL 200 PHG 50	DHS MCL 50	Revised MCL proposed
Thallium	DHS/EPA MCL 2 PHG 0.1		Awaiting completion of DLR study
1,2,4-Trichlorobenzene	DHS/EPA MCL 70 PHG 5 DLR 0.5	DHS MCL 5	Revised MCL proposed
1,1,2-Trichloroethylene (TCE)	DHS/EPA 5 PHG 0.8 DLR 0.5		Awaiting more studies

Source: Last update: 9 Jan 2001 < www.dhs.ca.gov/ps/ddwem/chemicals/PHGs/reviewstatus.htm>
MCL - Maximum Contaminant Level set by DHS or EPA
PHG - Public Health Goal established by CalEPA Office of Environmental Health Hazard Assessement (OEHHA)

2.3 DRINKING WATER QUALITY PARAMETERS OF CONCERN

2.3.1 DELTA WATER QUALITY CONCERNS

Pollutants in Delta waters come from tidal interaction and from point and nonpoint sources in the Delta and tributary watersheds, such as those of the Sacramento and San Joaquin River basins. Pathogens largely come from urban storm water runoff, livestock operations, recreational users, and, potentially, inadequately treated wastewater discharges. Sources of organic matter include runoff from soils, agricultural drainage, urban storm water, tidal wetlands, algae, and wastewater treatment plants.

The primary source of bromide is seawater intrusion and agricultural return water. Other sources of bromide may include geological formations, groundwater influenced by ancient sea salts, and the use of bromine-containing chemicals in the watersheds. Salinity sources, as reflected by total dissolved solids (TDS), include seawater intrusion and, to a lesser extent, from the natural leaching of soils, agricultural drainage, wastewater treatment discharges, and storm water runoff. Nutrient sources include soil erosion, agricultural runoff, livestock operations, urban storm water runoff, and wastewater discharges. Turbidity results from storm events, runoff, resuspended sediments, and phytoplankton. There is insufficient data to clearly establish the relative contributions of pollutants from each of these sources.

In a Comprehensive Monitoring, Assessment, and Research Program (CMARP) Report for the CALFED Bay-Delta Program (CALFED 2000), 7 drinking water parameters of concern were identified:

- TOC and dissolved organic carbon (DOC), which can serve as DBP precursors;
- Bromide, which is a precursor to forming brominated DBPs;
- Pathogenic organisms that can cause serious waterborne diseases;
- Chemical contaminants that can cause violations of drinking water MCLs;
- TDS or salinity that can cause taste and odor problems, corrosion of infrastructure and appliances, and impacts on wastewater reclamation programs, groundwater conjunctive use, and blending projects;
- Nutrients that can enhance nuisance algae blooms that affect water filtration and cause foul taste and odor problems, for example, geosmin and MIB (2-methylisoborneol); and
- Turbidity, which can impact filtration and disinfection treatment processes and requirements.

CALFED Bay-Delta Program actions presented in its *Programmatic EIS/EIR* (CALFED 2000) that could improve Delta water supplies with respect to these concerns would:

- Assure meeting current and future primary and secondary drinking water standards;
- Reduce public concern about the source and quality of drinking water from the Delta;
- Minimize water treatment costs to meet regulations;
- Reduce wide fluctuations in raw water quality with the result of improving the reliability of water treatment plant operations to meet standards and industries requiring consistent good water quality; and
- Reduce industrial pretreatment costs and production costs for industries, for example, electronics and pharmaceutical, that require high water quality.

The proposed CALFED actions are presented in Table 2-12.

Table 2-12 Potential Action Items for Improving Delta Drinking Water Quality

Subject	Potential action for near future implementation
Agricultural drains	Treat drainage, relocate discharge points, release drainage during ebb tides, implement BMPs, modify land management practices to reduce TDS, nutrients, TOC, salinity, and selenium, support land retirement of drainage impaired lands with local sponsorship.
Animal enclosures	Implement BMPs to reduce fecal matter and associate TOC, nutrients, pathogens into water sources.
Treated wastewater effluents	Improve treatment, relocate outfalls, implement watershed management plans, set total maximum daily loads (TMDLs) of pollutants.
Urban runoff	Treat drainage, relocate outfalls, set total maximum daily loads (TMDLs) of pollutants, implement watershed management plans.
Algae control	Treat water to kill or remove algae, control nutrient inputs, evaluate operational procedures.
Boating control	Implement education and enforcement programs to reduce discharges of fecal matter and other wastes to waterways.
Local watershed management	Support community-based watershed efforts to reduce non-point sources of contaminants.
Blending/exchange	Develop a Bay Area blending/exchange project with Bay Area water districts to address water quality and supply reliability. Facilitate water quality exchanges and similar programs to make high-quality Sierra water in the eastern San Joaquin Valley available to urban southern California.
Treatment	Invest in treatment technology demonstration.
Delta Drinking Water Council and Work Groups	Use the Council and its technical work group to develop necessary information on Delta water quality, identify appropriate treatment options, pursue source water exchange opportunities, and make other evaluations to meet CALFED's goal of continuous improvement in Delta water quality for all users.

Source: *CALFED Final Programmatic EIS/EIR* Jul 2000

2.3.2 CONTAMINANTS OF RECENT PUBLIC CONCERN

Some of the more publicized contaminants of concern during the past 5 years include chromium VI and chemical fuel-related compounds.

2.3.2.1 Chromium (hexavalent)

Total chromium in drinking water is regulated. The DHS MCL is 50 µg/L, which is lower than the EPA MCL of 100 µg/L. The World Health Organization uses 50 µg/L as a guideline for total chromium. These standards are considered protective of public health for both chromium-3 (trivalent) and chromium-6 (hexavalent), which is relatively more toxic. Chromium-3 is a required nutrient with a recommended daily average (RDA) dose of 50 to 200 µg. Chromium-6 can cause cancer in laboratory animals when inhaled. The evidence for carcinogenicity when ingested is not strong. CalEPA's OEHHA lists chromium-6 as a carcinogen, but it is not considered to pose a significant risk by ingestion if the standards are met. OEHHA established a PHG of 2.5 µg/L total chromium in drinking water. Because there is limited data on chromium-6 in drinking water supplies, DHS added chromium-6 to the list of unregulated chemicals for monitoring requirement, effective 3 January 2001. DHS will review the chromium MCL for possible revision when more data are collected.

2.3.2.2 DBCP (1,2-dibromo-3-chloropropane)

The current MCL for DBCP is 0.2 µg/L. The PHG is 0.0017 µg/L. In 1999 DHS began a review of the MCL for DBCP. A cost-benefit analysis was completed in February 2000. The evaluation led DHS to determine that no change in the MCL is required.

2.3.2.3 MTBE (Methyl tertiary butyl ether)

MTBE is a synthetic compound used mainly as a fuel oxygenate. The federal Clean Air Act Amendments of 1990 contained requirements for the use of oxygenated gasoline in areas that exceed the National Ambient Air Quality Standards for carbon monoxide and ozone. The Clean Air Act does not require any specific oxygenate, but MTBE is most commonly used. MTBE is added to gasoline to promote more complete combustion. Reformulated gasoline containing approximately 11% MTBE has been sold in California for many years to meet the state's air quality objectives. Increased MTBE usage has led to an increase in MTBE detections in surface and groundwater. Contamination sources include: leaking underground storage tanks (LUSTs), industrial releases, and emissions from watercraft.

Major potential sources of MTBE in surface waters include motorized recreational watercraft, accidental fuel spills, runoff, and precipitation. Exhaust from recreational watercraft, for example, boats and personal watercraft, is thought to be the major source of MTBE contamination in reservoirs (Dale and others 2000). For the State Water Project, the 2-stroke engine used on some boats and personal watercraft is a major source of MTBE contamination. These engines can expel as much as 25% of the fuel/oil mixture, uncombusted, into the water (DWR 1999).

Conventional water treatment processes do not remove MTBE, but some loss may occur due to volatilization during the treatment process (MWDSC 1998). After MTBE is introduced into a lake, its fate is determined largely by reservoir operation and environmental factors (Dale and others 2000). Volatilization is 1 of the main mechanisms by which MTBE is removed from surface waters, although rate of loss is low and depends on temperature and wind conditions.

In 1991, DHS established an advisory AL for MTBE of 35 µg/L. It was based on nononcogenic effects. In 1999, DHS lowered the AL to 13 µg/L because no health-based drinking water standard existed for MTBE. The EPA has established an AL of 20-40 µg/L in drinking water.

On 25 March 1999, Governor Gray Davis issued an executive order requiring MTBE to be phased out of California's reformulated gasoline by the final day of 2002. Reformulated gasoline will still need to meet the oxygen requirements of the Clean Air Act of 1990. Ethanol is a possible substitute for MTBE. The DHS MCL for MTBE is 13 µg/L in drinking water. DHS also adopted a PHG of 13 µg/L for MTBE. The goal for MTBE is based on oncogenic effects observed in laboratory animals. DHS has a secondary MCL for MTBE of 5 µg/L

Beginning in 2001, new regulations adopted by the California Air Resources Control Board will require manufacturers to reduce emissions from new outboard and personal watercraft engines. These regulations do not affect pre-2001 model year engines. These standards are based on exhaust emissions rather than on engine type. They do not ban 2-stroke engines, although carbureted 2-stroke engines, which can release 20% to 30% of their fuel unburned into the environment, will have a difficult time meeting the new emissions standards. Several 2-stroke direct-injection engines as well as 4-stroke engines are currently available that meet the new regulations (DBW 1999). These engine technologies should reduce the amount of MTBE released into surface waters.

2.3.2.4 NDMA (N-Nitrosodimethylamine)

NDMA is primarily used in research, but in the past it has been used in the production of 1,1-dimethylhydrazine for liquid rocket fuel and other industrial uses: a nematocide, a rubber plasticizer, in polymer synthesis, battery components, a solvent, an antioxidant, and lubricant additive. NDMA has been found in some foods, beverages, drugs, and in tobacco smoke. It also has been detected in polluted air, treated industrial wastewater, public wastewater treatment plant effluents near rocket fuel manufacturing plants, deionized water, high nitrate well water, and chlorinated drinking water.

NDMA is an identified carcinogen. There currently is no standard or approved analytical method for NDMA detection at very low levels. There also are no technologies for large-scale removal of NDMA from drinking water. In April 1998 DHS established an AL of 0.02 µg/L. However, analytical capabilities did not enable detection at that concentration, so any detectable quantity of NDMA exceeded the AL. Therefore, DHS later established a temporary AL of 0.02 µg/L for NDMA in November 1999. Utilities have been advised by DHS about actions that should be taken if the NDMA concentrations exceed the temporary AL.

2.3.2.5 Perchlorate

Perchlorate is a chemical used in a solid rock propellant (ammonium perchlorate) and other industrial applications. In 1997 DHS set a perchlorate AL of 18 µg/L. Since January 1999 perchlorate has been on the list of unregulated chemicals for which monitoring is required. Federal action on perchlorate is being coordinated by the Interagency Perchlorate Steering Committee. Since 1998, the committee has been focusing on analytical methods, treatment technologies, public outreach and communication, and the historical use and distribution of perchlorate, toxicology, risk assessment, and ecological effects.

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